UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/598,194	04/20/2007	Michael Sudakov	062918	1055

38834 7590 11/09/2009
WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP
1250 CONNECTICUT AVENUE, NW
SUITE 700
WASHINGTON, DC 20036

EXAMINER	
LOGIE, MICHAEL J	

ART UNIT	PAPER NUMBER
2881	

NOTIFICATION DATE	DELIVERY MODE
11/09/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentmail@whda.com

Office Action Summary	Application No. 10/598,194	Applicant(s) SUDAKOV ET AL.	
	Examiner MICHAEL J. LOGIE	Art Unit 2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 August 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10 and 14-18* is/are rejected.

7)☒ Claim(s) *11-13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

An “Amendment” was received on 24 August 2009, in response to Office Action of 24 March 2009. Claims 1, 2, 4, 7, 13-16 and 18 have been amended. Claims 19-20 have been canceled. Claims 1-18 are now pending.

Response to Arguments

Applicant's arguments filed 24 August 2009 have been fully considered but they are not persuasive.

The amended claim 1 has been amended such that it is drawn towards two separate inventive concepts: 1) structure of a tandem linear ion trap and TOF-MS and 2) the method of using the apparatus. Since the claim is written as a device, it is therefore patentable based on the structure defined in the limitations therefrom. These include: an ion trap, a set of electrodes, a set of DC voltage supplies providing discrete DC levels, a number of fast electronic switches, a neutral gas and a digital controller. MPEP 2114 recites that “A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987)”.

Therefore Okumura et al. (US pgPub 2003/00669958) is not overcome by these amendments since in figure 1 Okumura et al. teach an ion trap 5, a set of electrodes 4,

15 and 17, a set of DC voltage supplies providing discrete DC levels 41, 43 and 44, a number of fast electronic switches 48, a neutral gas 6 and a digital controller 14.

Pages 8-9 of the remarks discuss differences in the performance of the TOF mass analyzer, specifically stating “When RF voltage supply is turned off, the voltage in the ion trap does not disappear immediately.” Further the remarks go on to discuss that “residual voltages can be denied in the present invention by applying the reverse DC voltage.” This however is not reflected in the amendment because there is no limitation specifying an element that applies a reverse DC voltage. The present amendment merely limits the claim to "a set of DC voltage supplies to provide discrete DC levels for trapping ions, for optimizing the distribution of the trapped ions, and for ejecting the trapped ions from the ion trap and a number of fast electronic switches for connecting and disconnecting said DC supplies to at least two said electrodes of said ion trap.”

In paragraph [0043] Okumura et al. teach that “the controller 14 controls the magnitudes of the voltage to be applied to the gate electrode 4, ring electrode 15, endcap electrodes 16, 17 and orthogonal accelerator 18 as well as the timings of application thereof.” Even taking the method limitations of claim 1 into consideration Okumura teaches a set of DC voltage supplies to provide discrete DC levels (41, 43 and 44) for:

1) trapping ions ([0038] discusses the grounded endcaps 16 and 17, which means that the magnitude of the respective DC supplies were set to a ground potential (a discrete voltage level) by controller 14)

2) optimizing the distribution of the trapped ions ([0043], controller 14 would inherently be set the system to optimizes to the distribution of the trapped ions to the best capability of the system to fit the requirement of the use. Further optimize is a relative term.), and

3) ejecting the trapped ions from the ion trap (as discussed in [0039])

and a number of fast electronic switches for connecting and disconnecting said DC supplies to at least two said electrodes of said ion trap (fig. 1, 48).

The arguments are therefore unpersuasive because they are not reflected in the claim limitations.

Further Applicant's arguments with respect to claims 1-18 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

Claims 11-13 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In regards to dependent claim 11, prior art fails to disclose wherein an opposite pair of electrodes (Y pair) of said set of electrodes is connected to a first subset of said number of said fast electronic switches capable of switching at a repetition rate, and at least one of another oppositely positioned pair of electrodes (X pair) of said set of electrodes is connected to a second subset of said number of said fast electronic

switches which has a higher voltage rating, said second subset of fast electronic switches connects said DC voltage supply to said X electrodes for ejection of said ions.

Claims 12-13 are objected to by virtue of their dependencies on the dependent claim 11.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Okumura et al. (US pgPub 2003/0066958).

In regards to claim 1, Okumura et al. teach a tandem linear ion trap and time-of-flight mass spectrometer (figure 1, although a three-dimensional trap is shown here paragraph [0063] describes that this method would also be effective in a linear ion trap as well), the ion trap having a straight central axis orthogonal to the flight path of said time-of-flight mass spectrometer (the straight line axis starts at the ion source 2 through the trap 5 and into the orthogonal TOF mass orthogonal accelerator 18) and comprising; a set of electrodes (fig. 1, 15, 16, 17), at least one said electrode having a slit for ejecting ions towards said time-of flight mass spectrometer (slit in 16 and 17); a set of DC voltage supplies (41,43 and 44) to provide discrete DC levels for trapping ions, for optimizing the distribution of the trapped ions, and for ejecting the trapped ions from the

ion trap (as discussed in the arguments above) and a number of fast electronic switches (switches seen in dotted box 48) connecting and disconnecting said DC supplies to at least two said electrodes of said ion trap ([0037]); a neutral gas filling the volume of said ion trap in order to reduce the kinetic energy of trapped ions towards equilibrium (fig. 1,6 note: [0076], note: it is interpreted that increasing the trapping efficiency is equivalent to reducing the kinetic energy because the ions require low energy in order to be efficiently trapped);a digital controller (fig. 1, 14) to provide a switching procedure for ion trapping, manipulations with ions, cooling and including one state at which all the trapped ions are ejected from said ion trap towards said time-of-flight mass spectrometer ([0043]-[0044]).

In regards to claim 4, Okumura et al. teach a tandem linear ion trap and time-of-flight mass spectrometer according to claim 1 wherein said neutral gas has a molecular mass smaller than the mass of ions of interest ([0076], note: helium) and said ion trap is filled with said neutral gas to a pressure in the range from 0.01 mTorr to 1 mTorr ([0076], note: "the degree of vacuum within the ion trap is about 1 mTorr").

In regards to claim 5, Okumura et al. teach tandem linear ion trap and time-of-flight mass spectrometer according to claim 1, wherein said digital controller includes a digital processor capable of calculating an arbitrary switching sequence and control means to control a set of said number of said fast electronic switches according to said arbitrary switching sequence ([0043]- [0044], note: "the controller 14 controls the magnitudes of the voltage to be applied to the gate electrode 4, ring electrode 15, endcap electrodes 16, 17 and orthogonal accelerator 18 as well as the timings of

application thereof" is interpreted to mean that the controller has both a digital processor and a means to control a set of the number of said fast electronic switches since it controls the "timing thereof" which is means it inherently has a processor).

In regards to claim 6, Okumura teaches a tandem linear ion trap and time- of-flight mass spectrometer according to claim 1, wherein said switching procedure includes a final step during which the voltages on said electrodes of said ion trap are periodically switched between a set of states and after a time sufficient for ion cooling the voltages on said electrodes of said ion trap are switched to a final said state for ejection of said ions from said ion trap (this claim is not a structural feature, but a recitation of how the switch is operated. This is non-limiting subject matter: "While features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function" note: MPEP 2114).

In regards to claim 7, Okumura teaches a tandem linear ion trap and time- of-flight mass spectrometer according to further including a pulsar (fig. 1,9) for introducing the ions ejected from the slit toward the time-of-flight mass spectrometer (as seen in figure 1, the slit in electrode 17 ejects on the path depicted by the arrow emanating from the ion source 2 to the pulser 9, which pulses the ions towards the TOF-MS), said time-of-flight mass spectrometer having a flight path positioned orthogonally to the central axis of the ion trap and the ejection path of ions (fig. 1, the flight path of the ions is shown to be orthogonal to the path of ions ejected from ion trap).

In regards to claim 8, Okumura teaches a tandem linear ion trap and time- of-flight mass spectrometer according to claim 7, wherein said pulsar is composed of two parallel plate electrodes, one of which is a semi-transparent mesh, each said parallel plate positioned parallel to the plane of said ejected ions ([0041]).

In regards to claim 9, Okumura teaches a tandem linear ion trap and time- of-flight mass spectrometer according to claim 7, wherein said pulsar is connected to a high voltage supply (fig. 1,49) by a set of fast electronic switches (fig. 1,46, 47) that are controlled by a controller (fig. 1, 14).

Claims 14-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Bateman et al. (US pgPub 2004/0026613).

In regards to claim 14, Bateman et al. teach a method of extracting ions from a linear ion trap (inherent in the apparatus of figure 3), said ion trap being driven by a set of digital switches (2-gang switch seen in figure 3 set so that the first through sixth sets of electrodes of the central groups of electrodes can be supplied with a DC potential selected by the switch, as well as the RF potentials.), said method comprising the following steps; trapping said ions in said ion trap by switching between a set of trapping states defined by a set of voltage states on the electrodes of said ion trap ([0198], note: “traveling wave ion guide 1 results in a series of DC potential wells reaching the end of the traveling wave ion guide 1 with each potential well or trapping region containing ions of similar mass to charge ratios.”); cooling said trapped ions by collisions with a buffer gas down to equilibrium ([0190], discusses collisional cooling of the ions with a buffer

gas): and switching from a pre-selected trapping state to a final ejection state ([0120] teaches ejection of ions, [0126] teaches the traveling wave guide provided by the switching dc potentials [0152] teaches ejection of ions as a result of the traveling wave) in condition of pure electrostatic field within the ion trap in a pre-selected time by elongating the switching period of the trapping states ([0085], [0149]-[0150]).

In regards to claims 15, Bateman teaches wherein said set of trapping states consists of two states (implicit), each of said states last for half of a set period ([0178], note: “The cycle time for the sequence of voltages on any one segment was 23 μs.”).

In regards to claim 16, Bateman teaches wherein said buffer gas fills said ion trap at pressures in the range from 0.01,Torr to 1mTorr ([0130] discusses this range of pressure).

In regards to claim 17, Bateman further teaches wherein said set period is in the range from 0.3 micro seconds to 1.0 micro seconds (fig. 3, since the switching is controlled it is interpreted that discovering the optimum or workable ranges involves only routine skill in the art).

In regards to claim 18, Bateman further teaches where the final trapping state prior to said ejection state has a duration of approximately one quarter of a set period (fig. 3, since the is controlled it is interpreted that discovering the optimum or workable ranges involves only routine skill in the art).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al. (US pgPub 2003/0066958) and further in view of Bier et al. (US patent no. 5,420,425).

In regards to claim 2, Okumura et al. differ from the claimed invention by not disclosing wherein said set of electrodes comprises 4 elongated electrodes arranged symmetrically with respect to each other, and arranged to be parallel with respect to an ion trap axis.

Bier et al. teach wherein said set of electrodes comprises 4 elongated electrodes arranged symmetrically with respect to each other, and arranged to be parallel with respect to an ion trap axis (fig. 2A).

Bier et al. modifies Okumura by teaching a form for the linear ion trap mentioned by Okurmura.

Since both Okurmura and Bier et al. teach ion traps, it would have been obvious to one of ordinary skill in the art to have the form of Bier et al. in the linear trap of Okurmura because the slot geometry is optimized to enable ions of different mass ranges to be scanned out of differently dimensioned slots.

In regards to claim 3, Okurmura differs from the claimed invention by not disclosing wherein said at least one electrode having a slit for ejecting ions has a surface of substantially hyperbolic shape with the centre of said slit positioned symmetrically with respect to the apex of said hyperbola.

Bier et al. teach wherein said at least one electrode having a slit for ejecting ions has a surface of substantially hyperbolic shape with the centre of said slit positioned symmetrically with respect to the apex of said hyperbola (fig. 2A, 204).

Bier et al. modifies Okumura by teaching a form for the linear ion trap mentioned by Okurmura.

Since both Okurmura and Bier et al. teach ion traps, it would have been obvious to one of ordinary skill in the art to have the form of Bier et al. in the linear trap of Okurmura because the slot geometry is optimized to enable ions of different mass ranges to be scanned out of differently dimensioned slots.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al. (US pgPub 2003/0066958) and further in view of Frazen (US patent no. 6,700,117).

In regards to claim 10, Okumura et al. differs from the claimed invention by not disclosing wherein the flight path of said time-of-flight mass spectrometer is positioned inline with the ejection path of ions.

Frazen teaches wherein the flight path of said time-of-flight mass spectrometer is positioned inline with the ejection path of ions (figure 1 shows the trap 12 with flight path 19, figure 3 shows that the ejection path 31 is inline with the flight path of the ions).

Frazen modifies Okumura et al. by providing the ejection and flight path of the ions in-line with each other.

Since both Okumura et al. and Frazen teach a TOF-MS, it would be obvious to one of ordinary skill in the art to have the trap alignment of Frazen in the device of Okumura because it would provide the time-of-flight spectrometer with an excellent mass resolving power due to the uniform initial energy and low energy spread of the ions.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Pertinent prior art is closely related art that individually or in combination could be considered grounds for rejection.

Kawato (USPN 6,380,666) teaches a 3D ion trap that provides high power switching to the end cap electrodes.

See references cited for a listing of the pertinent prior art found and the prior art found.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Logie whose telephone number is 571-270-1616. The examiner can normally be reached on 7:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on 571-272-2293. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. J. L./
Examiner, Art Unit 2881

/David A Vanore/
Primary Examiner, Art Unit 2881